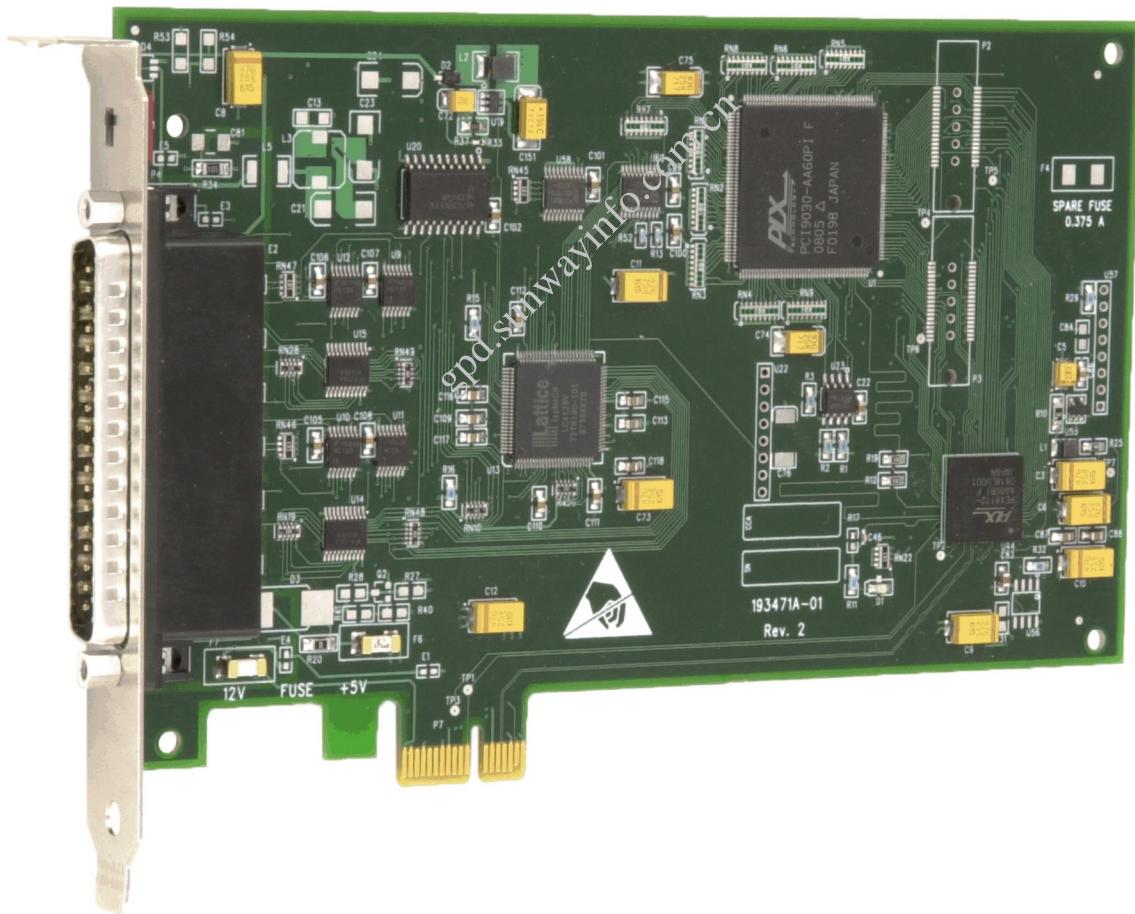


PCIe-DIO24

Digital Input/Output Board

User's Guide

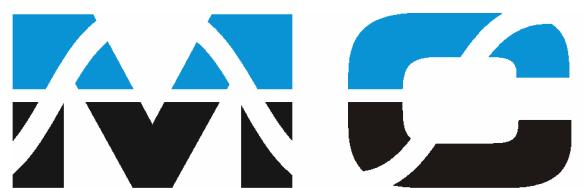


PCIe-DIO24

Digital Input/Output

User's Guide

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About this User's Guide

What you will learn from this user's guide

This user's guide explains how to install, configure, and use the PCIe-DIO24 so that you get the most out of its digital I/O features.

This user's guide also refers you to related documents available on our web site, and to technical support resources.

Conventions in this user's guide

For more information on ...

Text presented in a box signifies additional information and helpful hints related to the subject matter you are reading.

Caution! Shaded caution statements present information to help you avoid injuring yourself and others, damaging your hardware, or losing your data.

<#:#> Angle brackets that enclose numbers separated by a colon signify a range of numbers, such as those assigned to registers, bit settings, etc.

bold text **Bold** text is used for the names of objects on the screen, such as buttons, text boxes, and check boxes. For example:

1. Insert the disk or CD and click the **OK** button.

italic text *Italic* text is used for the names of manuals and help topic titles, and to emphasize a word or phrase. For example:

The *InstaCal* installation procedure is explained in the *Quick Start Guide*.
Never touch the exposed pins or circuit connections on the board.

Where to find more information

The following electronic documents provide helpful information relevant to the operation of the PCIe-DIO24.

- MCC's *Specifications: PCIe-DIO24* (the PDF version of the *Specifications* chapter in this guide) is available on our web site at www.mccdaq.com/pdfs/PCIe-DIO24.pdf.
- MCC's *Quick Start Guide* is available on our web site at www.mccdaq.com/PDFmanuals/DAQ-Software-Quick-Start.pdf.
- MCC's *Guide to Signal Connections* is available on our web site at www.mccdaq.com/signals/signals.pdf.
- MCC's *Universal Library User's Guide* is available on our web site at www.mccdaq.com/PDFmanuals/sm-ul-user-guide.pdf.
- MCC's *Universal Library Function Reference* is available on our web site at www.mccdaq.com/PDFmanuals/sm-ul-functions.pdf.
- MCC's *Universal Library for LabVIEW™ User's Guide* is available on our web site at www.mccdaq.com/PDFmanuals/SM-UL-LabVIEW.pdf.

PCIe-DIO24 User's Guide (this document) is also available on our web site at www.mccdaq.com/PDFmanuals/PCIe-DIO24.pdf.

Register-level programming

If you need to program at the register level in your application, you can find more information in the *Register Map for the PCIe-DIO24*. This document is available at www.mccdaq.com/registermaps/RegMapPCIe-DIO24.pdf.

Only experienced programmers should try register-level programming.

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Introducing the PCIe-DIO24

Overview: PCIe-DIO24 features

This manual explains how to install and use the PCIe-DIO24 board. The PCIe-DIO24 is a digital I/O board designed for the PCI Express (PCIe) bus.

The PCIe-DIO24 provides 24 lines of digital I/O with selectable 3.3 V and 5 V logic levels. The 24 DIO lines are organized into three groups of 8-bits each (Port A, Port B, and Port C). Port C can be further divided into two four-bit ports (Port C-HI and Port C-LO). The direction of each port is independently configurable with software for either input or output. Digital outputs are HC logic and can source and sink 2.5 mA.

The PCIe-DIO24 has a 10 k resistor network associated with each digital port. You can configure each port for pull-up or pull-down with software. On power up and reset the configuration of each port is read from EEPROM. The board is shipped with each port configured in the pull-up state.

The PCIe-DIO24 emulates the 82C55 Programmable Peripheral Interface (PPI) chip. Measurement Computing's Universal Library and Windows driver supports mode 0 only.

Digital I/O lines are accessible through a 37-pin D-type connector. The board has two individual slow blow fuses rated at 0.375 amp to protect the $+V_{DIO}$ and $+12V$ outputs on the connector. One spare fuse is provided.

Software programs written with the Universal Library for the USB-DIO24/37, PCI-DIO24 and CIO-DIO24 devices are fully compatible with the PCIe-DIO24.

Power is provided by the PCI Express slot. The PCIe-DIO24 board is completely plug-and-play. All board addresses are set by the board's plug-and-play software. Board configuration is controlled by your system's BIOS.

Software features

For information on the features of *InstaCal* and the other software included with your PCIe-DIO24, refer to the *Quick Start Guide* that shipped with your device. The *Quick Start Guide* is also available in PDF at www.mccdaq.com/PDFmanuals/DAQ-Software-Quick-Start.pdf.

Check www.mccdaq.com/download.htm for the latest software version.

PCIe-DIO24 block diagram

PCIe-DIO24 functions are illustrated in the block diagram shown here.

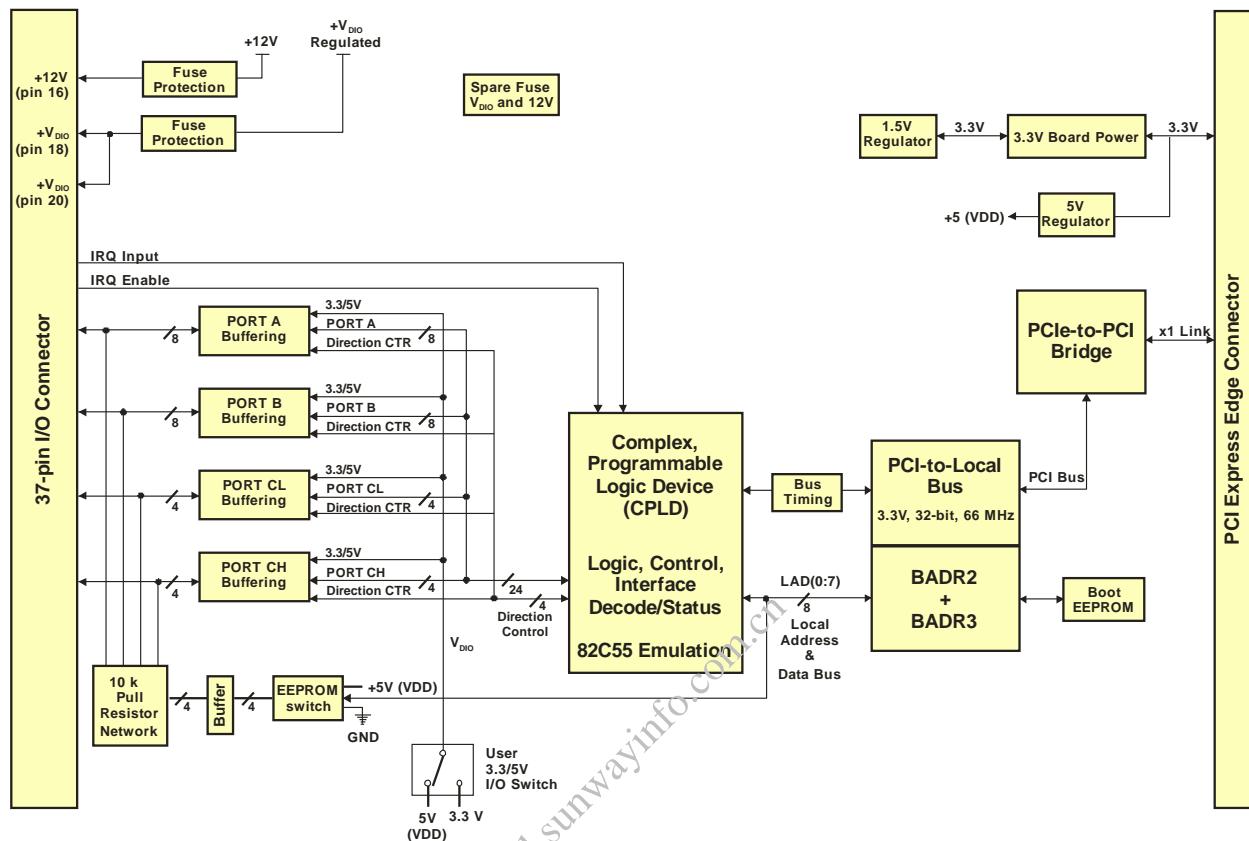


Figure 1. PCIe-DIO24 functional block diagram

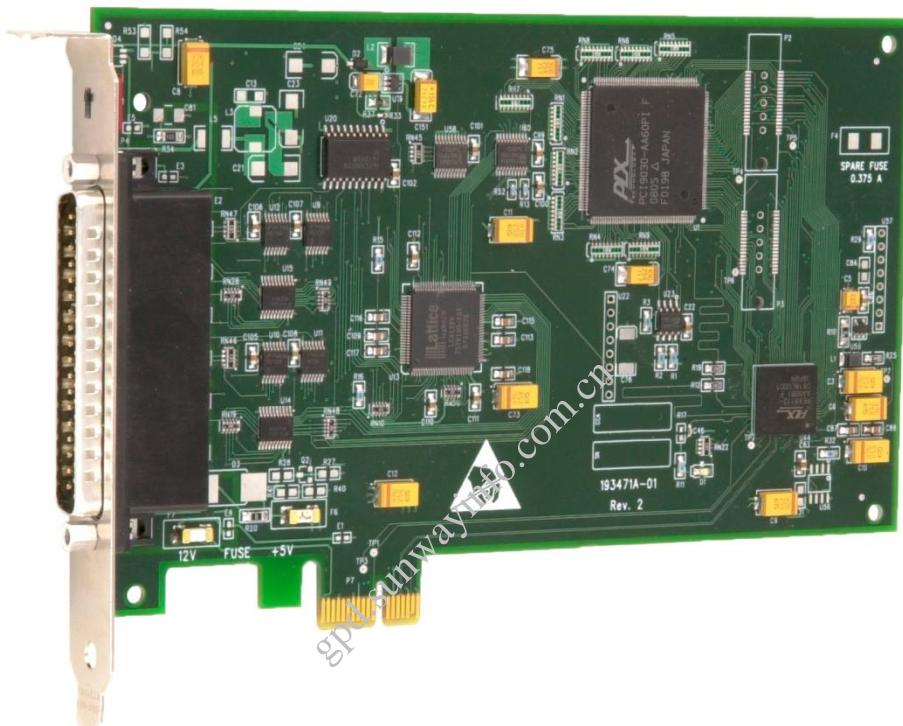
Installing the PCIe-DIO24

What comes with your PCIe-DIO24 shipment?

The following items are shipped with the PCIe-DIO24.

Hardware

- PCIe-DIO24



Additional documentation

In addition to this hardware user's guide, you should also receive the *Quick Start Guide* (available in PDF at www.mccdaq.com/PDFmanuals/DAQ-Software-Quick-Start.pdf). This booklet supplies a brief description of the software you received with your PCIe-DIO24 and information regarding installation of that software. Please read this booklet completely before installing any software or hardware.

Optional components

- Cables



C37FF-x



C37FFS-x

- Signal termination and conditioning accessories

Measurement Computing provides signal termination products for use with the PCIe-DIO24. Refer to the section "Field wiring and signal termination" on page 13 for compatible accessory products.

Unpacking the PCIe-DIO24

As with any electronic device, you should take care while handling to avoid damage from static electricity. Before removing the PCIe-DIO24 from its packaging, ground yourself using a wrist strap or by simply touching the computer chassis or other grounded object to eliminate any stored static charge.

If your PCIe-DIO24 is damaged, notify Measurement Computing Corporation immediately by phone, fax, or e-mail.

- Phone: 508-946-5100 and follow the instructions for reaching Tech Support.
- Fax: 508-946-9500 to the attention of Tech Support
- Email: techsupport@mccdaq.com

For international customers, contact your local distributor where you purchased the PCIe-DIO24.

Installing the software

Install the software included with your board before you install the hardware. Installing the software first ensures that the information required for proper board detection is installed and available at boot up.

Refer to the *Quick Start Guide* for instructions on installing the software on the *Measurement Computing Data Acquisition Software CD*. This booklet is available in PDF at www.mccdaq.com/PDFmanuals/DAQ-Software-Quick-Start.pdf.

Installing the hardware

The PCIe-DIO24 is completely plug-and-play. Configuration is controlled by your system's BIOS. To install your board, follow the steps below.

Install the MCC DAQ software before you install your board

The driver needed to run your board is installed with the MCC DAQ software. Therefore, you need to install the MCC DAQ software before you install your board. Refer to the *Quick Start Guide* for instructions on installing the software.

1. Power off and unplug the computer, and remove the cover to expose the expansion slots.
2. Touch any metal part of the computer to discharge static electricity that may be present. Static electricity can damage the board.
3. Insert the PCIe-DIO24 into an unused x1 PCIe expansion slot.

The PCIe-DIO24 is designed to install into an x1 slot. However, you can also install the board into an unused x4, x8, or x16 PCIe slot.

Caution! Ensure that you install the board into a PCIe slot. Installing the PCIe-DIO24 into a non-PCIe slot can damage both the board and the computer's motherboard.

4. Close your computer and turn it on.

A dialog box opens as the system loads, indicating that new hardware has been detected. The information file for this board should have already been loaded onto your PC when you installed the *Measurement Computing Data Acquisition Software CD* supplied with your board, and should be detected automatically by Windows. If you have not installed this software, cancel the dialog and install it now.

5. Run *InstaCal* to test your installation and to configure the pull direction of the digital port resistors.

Refer to the *Quick Start Guide* that came with your board for information on how to initially set up *InstaCal*.

Connecting the board for I/O operations

Main I/O connector

The table below lists the board connectors, applicable cables and compatible accessory boards.

Board connectors, cables, accessory equipment

| | | |
|---|--|---|
| Connector type | 37-pin D-type | |
| Compatible cables | C37FF-x unshielded ribbon cable. x = length in feet. (see Figure 3) C37FFS-x cable shielded round cable. x = length in feet. (see Figure 4) | |
| Compatible accessory products (with the C37FF-x or C37FFS-x cable) | SCB-37 CIO-MINI37 CIO-MINI37-VERT CIO-ERB08 | CIO-SERB08 CIO-ERB24 SSR-RACK08 SSR-RACK24 |

Connector pin out

The I/O connector is a 37-pin, male D-type connector accessible from the rear of the computer through the expansion backplate. The signals available are direct connections to the digital I/O chips as well as the computer's internal power supplies. The logic level switch sets the logic level for either 3.3V or 5V (refer to page 14 for switch information).

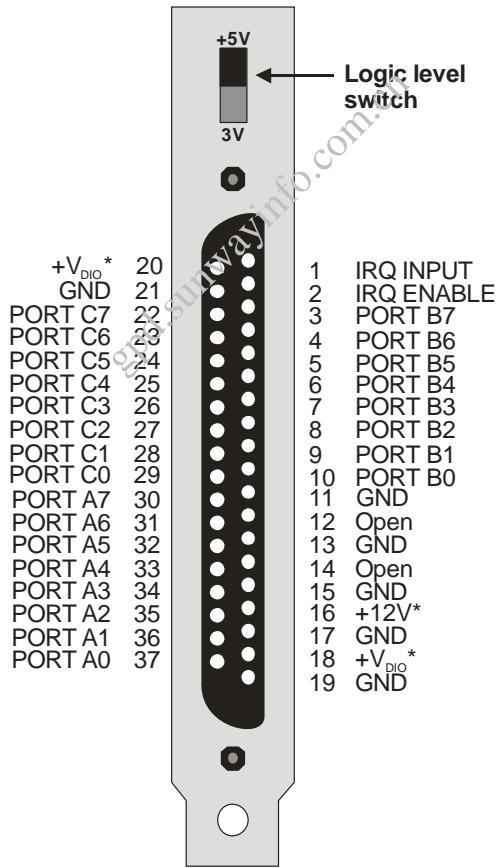


Figure 2. I/O connector

* The board has two individual slow blow fuses rated at 1 A. One fuse protects the 12V output at pin 16, and one fuse protects both +V_{DIO} outputs at pin 18 and pin 20.

Cabling

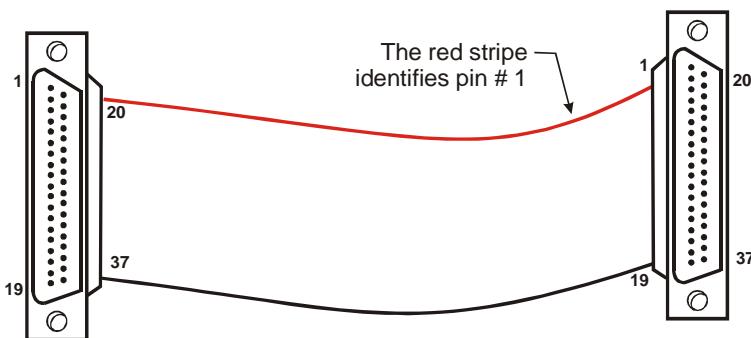


Figure 3. C37FF-x cable

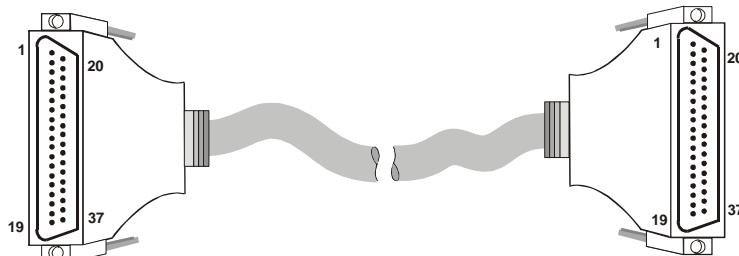


Figure 4. C37FFS-x cable

Field wiring and signal termination

You can use the following MCC screw terminal boards and relay racks with the PCIe-DIO24 board using the C37FF-x or C37FFS-x cable:

- SCB-37 – 37-conductor, shielded signal connection/screw terminal box that provides two independent 37-pin connections. Details on this product are available at www.mccdaq.com/cbicatalog/cbiproduct.asp?dept_id=196&pf_id=1166.
- CIO-MINI37 – 4 x 4, 37-pin screw terminal board. Details on this product are available at www.mccdaq.com/cbicatalog/cbiproduct.asp?dept_id=102&pf_id=255.
- CIO-MINI37-VERT – 37-pin screw terminal accessory with vertical 37-pin male D connector. Details on this product are available on our web site at www.mccdaq.com/cbicatalog/cbiproduct.asp?dept_id=102&pf_id=256.
- SSR-RACK24 – 24-position solid state relay rack. Details on this product are available on our web site at www.mccdaq.com/cbicatalog/cbiproduct.asp?dept_id=122&pf_id=1193.
- SSR-RACK08 – Eight-channel solid state relay rack. Details on this product are available on our web site at www.mccdaq.com/cbicatalog/cbiproduct.asp?dept_id=122&pf_id=620.
- CIO-ERB08 – Eight-channel electromechanical relay accessory for digital I/O boards. Details on this product are available on our web site at www.mccdaq.com/cbicatalog/cbiproduct.asp?dept_id=123&pf_id=241.
- CIO-SERB08 – Eight Form C and ten socketed relay accessory for digital I/O boards. Details on this product are available on our web site at www.mccdaq.com/cbicatalog/cbiproduct.asp?dept_id=123&pf_id=680.
- CIO-ERB24 – 24-channel electromechanical relay accessory for digital I/O boards. Details on this product are available on our web site at www.mccdaq.com/cbicatalog/cbiproduct.asp?dept_id=123&pf_id=241.

For additional information about digital interfacing...

Detailed information regarding digital interfacing is contained in MCC's *Guide to Signal Connections*. This document is available on our web site at www.measurementcomputing.com/signals/signals.pdf.

Functional Details

82C55 emulation

The PCIe-DIO24 emulates the 82C55 Programmable Peripheral Interface (PPI) chip. Measurement Computing's Universal Library and Windows driver supports mode 0 only.

Whenever the board is powered on or reset, all pins are set to high-impedance input. Based on standard TTL functionality, these inputs typically float high, and may have enough drive current to turn on external devices. Consequently, if you have output devices such as solid state relays, they may be switched on whenever the computer is powered on or reset. To prevent unwanted switching, and to drive all outputs to a known state after power on or reset, configure each port resistor with *InstaCal*.

Unconnected inputs float to the pull direction

Unconnected inputs will float in the pull direction that is configured for the port with *InstaCal* (either up/high or down/low).

Replacing a fuse

The PCIe-DIO24 has two individual 0.375 amp slow blow fuses. One fuse is connected to the 12V output at pin 16, and is labeled **F7** on the board. The second fuse is connected to both $+V_{DIO}$ outputs at pin 18 and pin 20, and is labeled **F6** on the board. A spare fuse is installed on the board at location **F4**. All fuses are secured to the board with clips for convenient replacement.

A fuse will blow during operation if amperage exceeds 0.375 amp. If you need to replace a fuse, perform the following procedure.

1. Hold the center of the blown fuse and pry it from the fuse holder clip.
2. Insert the replacement fuse into the fuse holder clip.

Fuse specifications

Refer to the information below to purchase additional fuses, if required:

- Manufacturer: Littelfuse®
- Type: 452 Series NANO[®] Slo-Blo[®] Subminiature Surface Mount Fuse
- Part number: 0452.375
- 0.375 amp, 125 volts, 1.2 Ω

Logic level switch

Use switch S1 to set the logic level for either 3.3V or 5V (default). The switch is located above the I/O connector (see Figure 2 on page 12).



Figure 5. Logic level select switch

Specifications

All specifications are subject to change without notice.

Typical for 25 °C unless otherwise specified.

Digital input / output

Table 1. Digital I/O specifications

| | | |
|-----------------------------|-------------|--|
| Digital type | | 82C55 Emulation |
| Configuration | | 2 banks of 8, 2 banks of 4, programmable by bank as input or output |
| Output | | Ports A and B: 74HC245A Port C: 74HC126 |
| Input | | Ports A and B: 74HC245A Port C: 74HC125 |
| Number of channels | | 24 I/O |
| Switch State | | Board Silk Screen Reference: S1 - Default +5V |
| 3.3 V | Output high | 2.8 volts min @ -2.5 mA |
| | Output low | 0.3 volts max @ 2.5 mA |
| | Input high | 2.6 volts min, 3.6 volts absolute max |
| | Input low | 1.3 volts max, -0.5 volts absolute min |
| 5 V | Output high | 4.5 volts min @ -2.5 mA |
| | Output low | 0.3 volts max @ 2.5 mA |
| | Input high | 2.6 volts min, 5.5 volts absolute max |
| | Input low | 1.3 volts max, -0.5 volts absolute min |
| Power-up / reset state | | Input mode (10 kΩ impedance from pull-up or pull-down) |
| Pull-up/pull-down resistors | | EEPROM stored - Software Programmable driven by 74ACT244 through 10 kΩ bussed resistor networks (shipped in the pull-up state) |
| Interrupt enable | | External (IRQ ENABLE, active low, disabled by default through internal resistor to TTL high) and programmable through PCI9030; 0 = disabled, 1 = enabled (default) |
| Interrupt sources | | External source (IRQ INPUT), polarity programmable through PCI9030; 1 = active high, 0 = active low (default) |

Power Consumption

Table 2. Power consumption specifications

| | |
|---|---|
| +3.3 V operating | 515 mA typical |
| +3.3 V with 5 V I/O | 520 mA typical |
| +V _{DIO} User Output | 125 mA max. @ +5V; 375 mA max. @ +3.3 V |
| Fuses: +V _{DIO} User Output +12 V | 0452.375 - Littelfuse 0.375A NANO [®] Slo-Blo [®] Subminiature Surface Mount Fuse |

Environmental

Table 3. Environmental specifications

| | |
|-----------------------------|-------------------------|
| Operating temperature range | 0 to 50 °C |
| Storage temperature range | -20 to 70 °C |
| Humidity | 0 to 90% non-condensing |

Mechanical

Table 4. Environmental specifications

| | |
|-----------------|---|
| Card dimensions | 167.4 mm (L) x 111.2 mm (H) x 18.72 mm (W) 6.59" (L) x 4.38" (H) x 0.74" (W) |
|-----------------|---|

General

Table 5. General specifications

| | |
|-----------|---------------------|
| Bus Type | PCI Express 1.1 |
| Bus Width | x1 lane PCI Express |

Main connector and pin out

Table 6. Main connector specifications

| | | |
|---|--|--------------------------|
| Connector type | 37-pin D-type | |
| Compatible cables | C37FF-x unshielded ribbon cable. x = length in feet. C37FFS-x cable shielded round cable. x = length in feet. | |
| Compatible accessory products (with the C37FF-x or C37FFS-x cable) | SCB-37 CIO-MINI37 CIO-MINI37-VERT | |
| Compatible accessory products with S1 in the +5 V position (with the C37FF-x or C37FFS-x cable) | CIO-ERB08 CIO-SERB08 CIO-ERB24 | SSR-RACK08 SSR-RACK24 |

Table 7. Main connector pin out

| Pin | Signal Name | Pin | Signal Name |
|-----|---------------------|-----|---------------------|
| 1 | IRQ INPUT | 20 | +V _{DIO} * |
| 2 | IRQ ENABLE | 21 | GND |
| 3 | Port B7 | 22 | Port C7 |
| 4 | Port B6 | 23 | Port C6 |
| 5 | Port B5 | 24 | Port C5 |
| 6 | Port B4 | 25 | Port C4 |
| 7 | Port B3 | 26 | Port C3 |
| 8 | Port B2 | 27 | Port C2 |
| 9 | Port B1 | 28 | Port C1 |
| 10 | Port B0 | 29 | Port C0 |
| 11 | GND | 30 | Port A7 |
| 12 | OPEN | 31 | Port A6 |
| 13 | GND | 32 | Port A5 |
| 14 | OPEN | 33 | Port A4 |
| 15 | GND | 34 | Port A3 |
| 16 | +12V* | 35 | Port A2 |
| 17 | GND | 36 | Port A1 |
| 18 | +V _{DIO} * | 37 | Port A0 |
| 19 | GND | | |

* Protected by slow blow fuses rated at 0.375 A. One fuse protects pin 16 (+12V), and the second fuse protects pin 18 (+V_{DIO}) and pin 20 (+V_{DIO}).

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